


FACTS AND FIGURES ON OZONE PROTECTION

Ozone treaties

1. The 1985 Vienna Convention for the Protection of the Ozone Layer and its 1987 Montreal Protocol on Substances that Deplete the Ozone Layer were established to protect human health and the environment from the threat of ozone depletion as exemplified by the ozone hole. Both have achieved universal ratification, with 198 Parties.
2. The Vienna Convention calls on Parties to cooperate on scientific research and observations. The Montreal Protocol controls nearly 100 manufactured ozone-depleting substances (ODS), most of which are also potent greenhouse gases. It also now controls 18 hydrofluorocarbons (HFCs), which are powerful greenhouse gases that do not destroy ozone.
3. Implementation of the Montreal Protocol has led to the phase-out of 98.6 per cent of ODS, or 1.75 million Ozone Depletion Potential (ODP) tonnes, globally. The remaining 1.4 per cent is mainly hydrochlorofluorocarbons (HCFCs).
4. The Kigali Amendment added HFCs to the list of controlled substances to protect future climate from the global emissions of these powerful greenhouse gases. The Amendment entered into force on 1 January 2019.
5. As of June 2020, four amendments to the Montreal Protocol – the London, Copenhagen, Montreal and Beijing amendments – have been ratified by 197 out of 198 parties. The fifth and most recent, the Kigali Amendment, has been ratified by over 95 parties.

Ozone and climate benefits

6. For the last two decades, some signs of recovery of the ozone layer have been observed. For example, in the mid-latitudes, upper stratospheric ozone has increased by 1–3 per cent per decade since 2000.
 7. Assuming continued compliance with the Montreal Protocol, the expected recovery of the ozone layer is as follows:
 - In the Antarctic, springtime column ozone returns to 1980 values in the 2060s;
 - In the Northern Hemisphere, mid-latitude ozone returns to 1980 values by the 2030s;
 - In the Southern Hemisphere, mid-latitude ozone returns to 1980 values around mid-century.
 8. Without the Montreal Protocol, the Antarctic ozone hole would have been about 40 per cent larger by 2013 and deeper Arctic ozone depletion would have occurred in the very cold winter of 2011.
 9. Ozone protection efforts have contributed significantly to slowing climate change by avoiding an estimated 135 billion tonnes of carbon dioxide (CO₂) equivalent emissions from 1990 to 2010. This is five times larger than the annual emissions reduction target for the first commitment period (2008–2012) of the Kyoto Protocol, the predecessor to the Paris Agreement on Climate Change.
 10. Models indicate that in the absence of the Montreal Protocol, global mean temperatures would have risen over 2°C by 2070, due to warming from ozone-depleting substances alone, and that tropical cyclones would likely have been three times as intense in 2065.
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Health benefits

11. NASA model simulations have shown that without the Montreal Protocol, global ozone would have fallen so low by 2065 that light-skinned people in northern mid-latitude locations would have perceptible sunburn in about 5-10 minutes during summer outdoors.
12. With the Montreal Protocol, up to 2 million cases of skin cancer may be prevented globally each year by 2030.
13. In the United States, full implementation of the Montreal Protocol is expected to prevent approximately 443 million cases of skin cancer, 2.3 million skin cancer deaths, and 63 million cases of cataracts for people born in the years 1890–2100, according to the US Environmental Protection Agency.

Economic benefits

14. The Montreal Protocol established the Multilateral Fund for the Implementation of the Montreal Protocol to cover work in developing countries. As of December 2019, contributions had reached US\$4.07 billion. The Fund has also received additional voluntary contributions of US\$25.5 million from a group of donor countries to finance fast-start activities for the implementation of the HFC phase-down.
15. The Montreal Protocol will result in an estimated US\$1.8 trillion in global health benefits (US\$1.109 trillion for skin cancer alone) and almost US\$460 billion in avoided damages to agriculture, fisheries, and materials (both cumulative estimates from 1987 to 2060).



Looking to the future

16. The Montreal Protocol's success inspired an effort to avoid HFCs, which have been used as replacements for many banned gases. The average global warming impact of 22 of the most used HFCs is about 2,500 times that of CO₂. HFC emissions increased by 23 per cent from 2012 to 2016.
17. The Kigali Amendment requires a phasedown of 18 high global warming potential HFCs by more than 80 per cent (in CO₂-equivalent) from the baseline level over the next 30 years.
18. Estimates suggest that emissions avoided by 2100 could reach 420 gigatonnes of CO₂-equivalent, which is more than 10 years of present-day annual emissions of CO₂ due to human activities. This will avoid up to 0.4°C of global warming by the end of the century.
19. Replacing HFCs also creates an opportunity to increase energy efficiency of cooling equipment by 10–50 per cent, significantly reducing energy costs to consumers and businesses.
20. Substantial recovery of the ozone layer from the effects of ODS is projected to occur around the middle of this century, assuming global compliance with the Montreal Protocol. As the level of ODS decline throughout the world in the coming decades, the evolution of the ozone layer will be increasingly influenced by future abundances of greenhouse gases and climate change.

* Scenarios for years in the distant future such as 2100 are illustrative of the scale of possible emissions due to large uncertainties related to the assumptions involved